

FixMyStadtmelder: Challenges and Solutions in Civic Services for Smart Cities and Regions

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Abstract

Dozens of municipalities across Switzerland have introduced new digital interfaces for interacting with citizens. Among the widely used ones are interactive applications to report damage or needs, collectively called civic engagement services for issue tracking. We argue that while they are popular and effectively encourage crowdsourcing with residents, from a computer science perspective many current systems have issues, including in data privacy and operation efficiency. To overcome them, we propose specific improvements and outline a vision for smart digital spaces in which various stakeholders around smart cities and regions can participate.

Keywords

smart cities and regions, cloud computing, privacy

1. Introduction

Citizens and residents increasingly expect a service-oriented public administration. In conjunction with digitalisation, this leads to the offering of online services for e-government. These services range from online counters with simple digitalised forms of existing administrative inquiries to more interactive, transparent and attractive services on dedicated platforms [1, 2].

For about a decade, a primary representative of these services has been civic participation and engagement by pinpointing damages and other issues in public infrastructure [3]. Citizens observe overfull trashcans next to a bus stop, potholes in a street or a dead animal on a sidewalk, and report that case with address information and potentially a photo to the authorities through a unified interface. A dispatcher then forwards the request to the relevant agencies and departments, or alternatively is a role within those, and reports back any progress and eventual resolution of the issue. In that sense, civic services are similar to other issue trackers and ticket systems known from collaborative software development and service desks streamlining ICT operations [4], but tightly bound to public space, geographic locations and more complex organisational responsibilities.

In Switzerland, such facilities are not yet ubiquitously adopted but are nevertheless in use with several large, mid-sized and even small municipalities. On the technical level, they range from simple web-based submission forms to more sophisticated trackers optimised for mobile devices.

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Both domestic and international software products are purchased by cities, local authorities and other public infrastructure maintainers such as public service and utility providers. Among the widely used platform products are those from Anthrazit (Citymobile/Melder), ICLIP (PuraCittà), the Swiss Post (My Local Services) and MySociety (FixMyStreet and derivatives). Cities then customise these products into solutions for their residents, in particular concerning the eligible damage categories. In some cases, they integrate them with self-monitoring devices and with open government data (OGD) platforms. Fig. 1 shows an example report from the city of Schaffhausen on a defect in a public barbecue place.

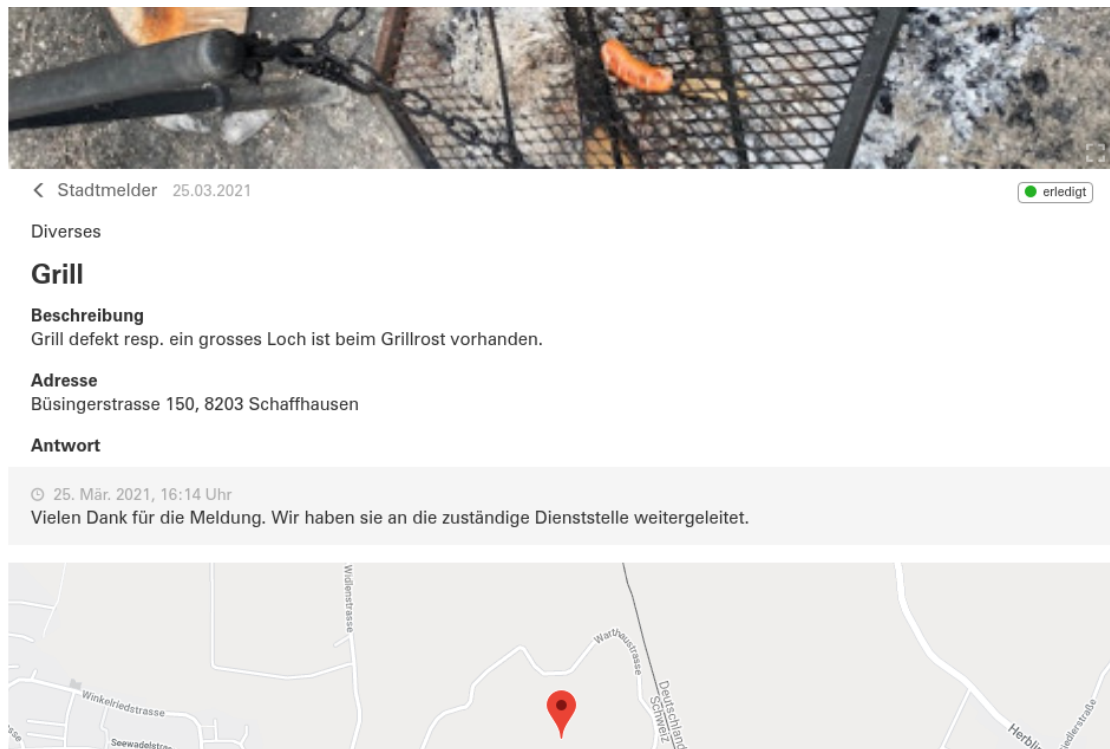


Figure 1: Typical issue report format and progress tracking (in German)

While such solutions have been gradually introduced in recent years by frontrunner municipalities, there has so far not been an analytical study (with the exception of a data review in Zurich [5]) of how they are used and what problems, especially concerning the emerging digital society, are associated with current platforms. This hinders these services to drive a notion of stronger 'service public' in the digital space, providing a raised baseline of service quality expected by residents for the cost of life in Switzerland. In this paper, we first analyse data from four deployments, and contribute insights into engagement, form and language. Subsequently, we identify three privacy problems as well as deficiencies with service orientation, user-generated content handling, insights, federation and synergies. Finally, we outline a vision for a shared digital space with measurable 'service public' guarantees for smarter cities and regions.

2. Civic Platform and Data Analytics

2.1. Data sources

We inspect and compare the reports from four cities in the German-speaking area of Switzerland: Zurich and its MySociety-based 'Züri wie neu' system, as well as Schaffhausen, St. Gallen and Winterthur, all using the Anthrazit system. All data records are taken on April 9, 2021, and the population records are taken from the Federal Statistical Office's STATPOP for December 31, 2019, the most recent authoritative records valid on January 1, 2021, not accounting for the growth dynamics in previous years. The incidence rate IR refers to daily reports per 100k inhabitants. A high incidence may signal engaged citizens, but also broken municipal infrastructure, and shall therefore not be used as rating metric.

Table 1

Civic service overview

City	Inhab.	System	Since	Reports	IR
Schaffhausen	37k	Anthrazit	May 2017	1177	2.24
St. Gallen	76k	Anthrazit	June 2016	2840	2.13
Winterthur	113k	Anthrazit	May 2017	4488	2.79
Zurich	420k	MySociety	March 2013	27368	2.21

Table 1 summarises the key metrics regarding the service usage. Despite a factor of more than 11x in difference between population, and a factor of 2x in deployment history, the IR bracket is small with a factor of 1.3x.

2.2. Platform Insights

My Local Services and PuraCittà are apps limited to two mobile platforms, whereas the other platforms are available as mobile-optimised and cross-platform web applications. Despite a general trend towards open and sustainable government, of the studied systems and other mentioned products only the Zurich deployment is based on an open source core. That deployment is furthermore seamlessly integrated with the city's OGD portal, allowing to export the whole dataset or geographically bounded portions and thus facilitating detailed council-level analysis of issues. The other deployments do not have this integration. However, data access in semi-structured format is possible due to the public nature of the trackers.

All of the platforms are explicitly bounded by the administrative area. This means that commuters or hikers, for instance, would need to actively check which territory they are on to select the right civic service. Dispatchers can either make them aware of discrepancies (and reject the report) or forward reports, but our hypothesis is that the forwarding only happens for distinct responsibilities within cities. We analyse reports to that extent but note that the underlying software products themselves would need better federation support to support such forwarding. The PuraCittà product is reported to support federation, however this could not be verified due to the lack of public deployments. The Zurich solution supports the Open 311 standard that would enable federation [6, 7], but this is not currently used due to a lack of peering systems.

All platform solutions are operated as SaaS by the vendors on behalf of and with the branding of the respective cities. This poses questions concerning ownership of user-generated content and data sovereignty along with economic effects should more deployments occur.

2.3. Reports Insights

We apply methods from natural language processing (NLP) and time series analysis as well as statistics to further understand the nature of issue reports. The focus here is not on a conclusive data science study, but rather the extraction of weaknesses and limitations that inspire next-generation civic platforms.

Processing Each issue is subject to state transitions. In the simpler state chart of the MySociety product, there is only one transition from 'registered' to 'answered', although multiple updates are possible. Additionally, there is the option to discard inappropriate reports. In the more sophisticated state chart of the Anthrazit product, the chain ranges from 'registered' over 'in processing' to 'answered' and 'done'. However, the visual indication for 'answered' equals the one to 'done' despite that it merely means an ongoing dispatch.

Photos The supply of photos helps dispatchers and municipal workers to anticipate the damage fixing effort. Our findings show that the supply of photography differs by a factor of 1.5x, ranging from 37.9% in Winterthur over 44.8% in St. Gallen to 57.8% in Zurich. The Zurich deployment allows for uploading multiple photos and might therefore encourage photo supply in general. We also found that many of the Zurich reports relate to graffiti that lend themselves to photography. In all deployments, uploaded photos are cleansed and size-normalised to avoid potentially privacy-sensitive residues such as EXIF metadata.

Locations Civic issue reporting is inherently bound to geo-locations as far as physical infrastructure is concerned. Most of the times, these are expressed as street addresses, although we have observed that no validation takes place in some deployments. This leads to inconsistencies in few cases and prevents further automated processes from working smoothly. We expect location to become a stronger initiation point for civic engagement on a higher level – in the sense of: *Here I am, and I would like to suggest a change for the better or report broken infrastructure or discuss with somebody responsible for this place. Make it happen.*

Language While we do perform a detailed linguistic survey down to the level of varieties, it is apparent that by far most residents communicate in Swiss High German with authorities. There are very few reports in Swiss German or English as only deviations, amounting to far less than 1% of all reports, even including ambiguous reports consisting of only a loanword such as 'littering' or a snarky remark such as 'no comment'. In contrast, around 2% of reports hint at Standard German.

The linguistic quality is mixed, with frequent occurrences of typos and miscapitalisation. We assume that this stems in part from the use of mobile devices and is not a major hurdle for daily operations but nevertheless point out the potential of text auto-correction to improve

the overall service quality and appearance. We also note that there are no grave emotional outbursts – these are likely deleted right away – but there are some reports with sarcastic intonation regarding for instance repetitive events or issues that have not been resolved despite long waiting time. There are also wishlist issues that for all of the deployments are considered out of scope. We report on those characteristics only qualitatively to underline the need for further linguistic analysis.

Categories All surveyed services oblige custom categories, from 8 in St. Gallen to 11 in Winterthur. The number of categories and the scope of the issue reporting depends on municipal policies. For instance, in St. Gallen, dead animals and scooters are supposed to be reported to dedicated agencies, hinting at a missing integration behind the otherwise unified reporting interface. In all services, issues requiring immediate action are explicitly excluded as they are to be processed by police officers.

Apart from the official categories, auto-categorisation would be possible through NLP. Figs. 2, 3 and 4 compare the official, manually trained (based on predefined term mappings) and auto-trained categories, respectively, for the city of Schaffhausen. The manual training model has been transferred from the Winterthur dataset to demonstrate city-specific terminologies. As the high number of uncategorised issues in that categorisation shows, manual training needs to be conducted for each deployment depending on the local situation. In this particular case, words such as 'Licht' or 'Lampe' refer to street lighting in Schaffhausen but not in Winterthur, and terms for safety buoy and riverbank are also highly specific. The auto-NLP variant is immune against such preferences but requires semantic knowledge to combine words and avoid dozens of micro-categories. This can be seen in Fig. 4 that has five synonyms in its legend. Nevertheless, the advantage of NLP-based categorisation is more fine-grained separation of issues.

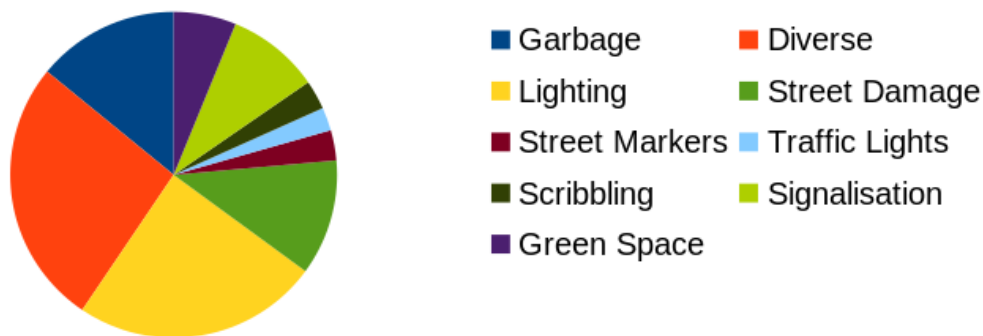


Figure 2: Breakdown of official categories

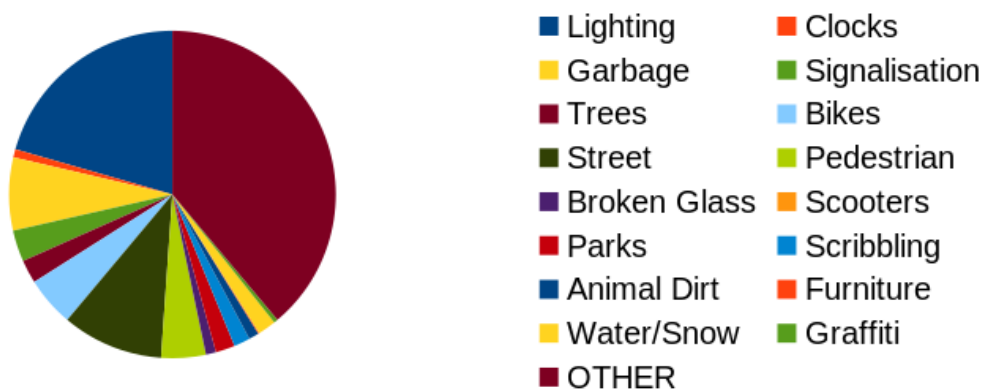


Figure 3: Breakdown of manually NLP-derived categories

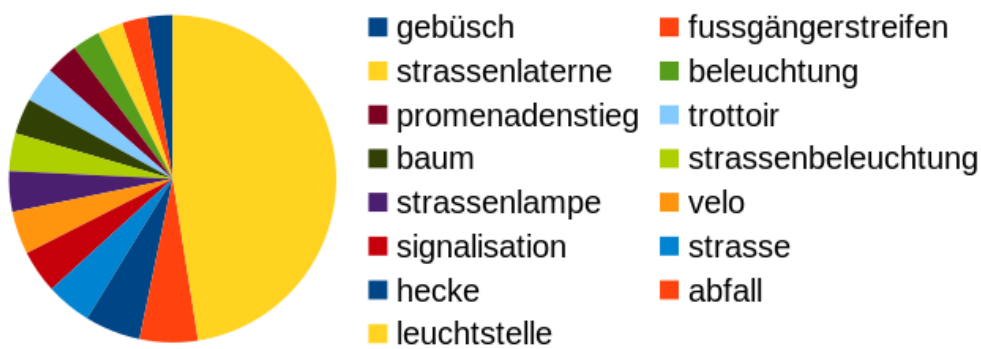


Figure 4: Breakdown of automatically NLP-derived categories (subset, all terms with 10+ occurrences)

3. Identified Problems

3.1. Data privacy

In contrast to many other e-government services, civic engagement is predestined to work with a more open model in which pseudonyms can be used and even anonymous use is possible. Indeed, the cities surveyed by us using a streamlined civic service do not require full identification, and are therefore open to issue reports even from tourists or visitors. On the contrary, many of the form-based approaches ask for mandatory identification information such as name and address.

Nevertheless, there are three concrete privacy issues related to the use of e-mail addresses, phone numbers and licence plates that would require more careful handling as well as the choice to supply them optionally to overcome them. First, some of the reports contain such contact data in the issue report itself, as evidenced by five occasions in the Zurich dataset. A more rigorous service would auto-filter such information for any public consumption. Second, this concerns the address line, as evidenced with a few cases in the other datasets. We believe

this is due to the ambiguity of the term 'address' and suggest more distinct naming of the fields, in addition to auto-filtering. Third, according to privacy regulations, data must not be collected for longer than necessary. In fact, the EU GDPR requires an explicit specification of storage duration, whereas the Swiss federal and cantonal laws know no such provision but imply it by the need to not collect only essential data. However, according to our analysis, there is no indication that contact data are removed once issues are marked as completed.

3.2. Service orientation

Modern software design, just like modern administration, calls for service orientation in order to allow for composition and engineering of higher-level services. This implies discoverable APIs and uniform interfaces. To give one concrete counter-example, the Anthrazit-based services deliver interactive web content in the legacy Latin1 (ISO-8859-1) encoding instead of UTF-8, causing unnecessary double friction for programmatic interface uniformity. In general, while the city of Zurich actively promotes OGD and open APIs, no city is currently up to standards with digital service management and digital ecosystem creation, following the ideas of a programmable web for residents.

3.3. Federated operation

Apart from administrations, there are many overlapping responsibilities. On the local level, some Swiss municipalities have citizen communities with proper land ownership, as well as private ground mistakenly assumed to be public space. On the regional level, there is damage reporting for slow traffic, and there are cantonal streets without proper reporting services. On the national level, there is reporting for hiking signature, as well as damage reporting by the Suisse ePolice. Additionally, there are national or regional vigilance campaigns, often related to biohazards and dangers such as ticks, tiger mosquitos and bird flu. Currently, no system is in place to take engaged residents through these options in a systematic and guided manner. Similarly, even when thinking of a common geo-aware frontend service, there is a need for mutual access by dispatchers to make sure all relevant issues are resolved. Recent progress of hierarchical and geo-aware topic aggregation in event-based messaging could be exploited to achieve such federations.

3.4. Synergetic operation

Synergetic benefits are likely to happen once civic services can be extended to operators of in-door and mixed public infrastructure such as pools, schools and sports facilities. Through an integration not only with geo-information systems (GIS) but also with building information models (BIM) and databases for ownership and responsibilities, as well as linkage to procurement systems to order repair services and replacement parts, damage reporting may turn into a pervasive activity. Currently, there is no support although the concept of PuraCittà foresees some of the procurement use cases.

4. Common Digital Space as 'Service Public'

In Switzerland, 'service public' is a unique concept to express the willingness to spend on quality public infrastructure and, therefore, quality of life. Traditionally reserved for the physical world, the concept now also covers media and broadband connectivity, but lacks an equivalent concept on the higher network layers, in particular application platforms and services. Public awareness of these topics has been raised recently due to the discussions around vaccination registration, digital identities and e-payment.

Civic services should therefore not be engineered in isolation, but based on shared platforms and functionalities to guarantee consistent behaviour concerning data privacy, service orientation, dependability, crowd engagement, participatory planning and other desired characteristics. This becomes even more important as the physical side of municipalities is increasingly equipped with sensors and smart object identifiers, leading to contextual data processing at massive scale and fusion opportunities and, consequently, new digital applications. There needs to be a strong first-class citizen consideration of identity, data ownership, service catalogues, federated topologies and bidirectional communication, along with cross-department and cross-agency stewardship for these crucial concerns.

Fig. 5 shows a potential geo-aware and smart-object-aware issue reporting for raising the service quality and offering a reliable initial experience independently from the underlying platform products. While a long way ahead, first prototyping and data curation steps towards a shared and community-maintained civic engagement experience are taken. The CH Engage prototype is publicly available at the site <https://serviceprototypinglab.github.io/ch-engage/> and offers innovation to vendors of smart city engagement software products.

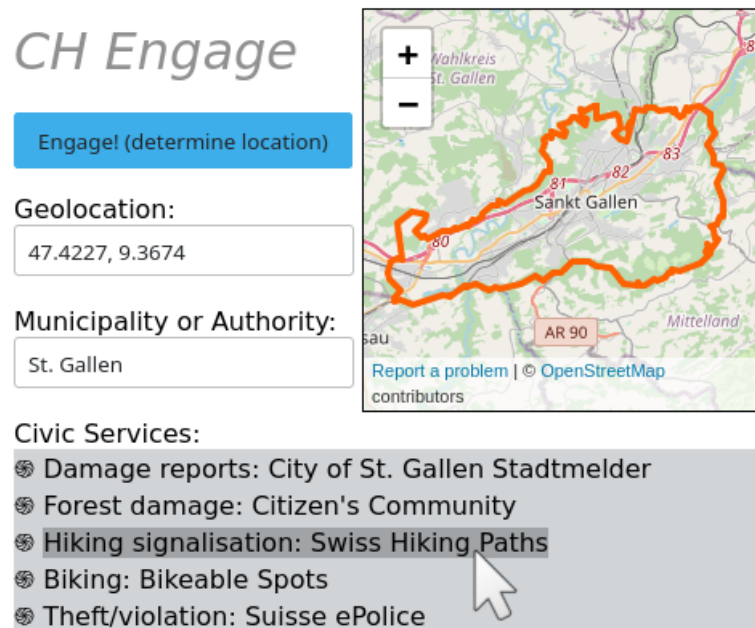


Figure 5: Context-aware issue reporting in the administrative area of St. Gallen

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